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ON THE USAGE OF CONCEPT CARTOONS IN TEACHING GEOMETRY: THE STUDY OF THE GEOMETRY ACHIEVEMENT OF MIDDLE-SCHOOL FIFTH GRADERS

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Abstract

İn this study; we examined the influence of concept cartoons on academic achievement in the 5th grade geometry class. Quantitave research method is used in the research. Randomized paired control-group pretest-posttest design from experimental research methods was used in the research. Experimental study was carried out with 24 fifth grade students studying in Aşağı Göndelen Secondary School in Ereğli Country of Konya Province. Experts have examined the materials of Geometry Achievement Test, have been tested for reliability and validity, and as a result the ‘‘Geometry Achievement Test’’ has been established to be reliable and valid. GBT was applied to a group of 24 students. Based on the results of the results of the pre-test GBT, the experimental group with 12 member, in which the geometry was tough with concept cartoons, and the control group with 12 member, in which the geometry was tough with traditional teaching was established so that the successes of students would be homogeneous. In the analysis of the data obtained from the experimental study; Independent samples t-test was used. As a result of the experimental research, it was seen that the students of the experimental group using the concept cartoons had higher geometry achievements than the geometric achievement of the control group students who were taught traditional geometry.

Keywords: Geometry education, concept cartoons, the level of success

INTRODUCTION

The sub-discipline that enables Mathematics to be disengaged from its abstract nature and turn into a visible concrete form, thus establishing a meaningful place in individuals' minds, is geometry (Keşan and Şahin, 2017). In order to free Geometry from that abstractness, it is required to associate it through perceivable-level finite objects from one's observable immediate surroundings (Dağlı & Peker, 2011). The individual who forms the geometric concepts in his/her mind would possess the ability of spatial reasoning in the geometric space. According to Duatepe Paksu (2013), the individuals who have the ability of spatial reasoning can look at their surroundings in a more meaningful way, and can solve the geometry problems that they might face in the daily life with more ease. Geometry is a discipline that equips the individual with sight, eases thinking, and enables reaching the solution via visualizing the objects (Hızarcı, 2004). The Geometry discipline, which can shape individual's life and helps people overcoming problems that they might face, is the indicator of how seriously the Plato's saying "Let no one ignorant of Geometry enter here" is grounded. According to Şahin (2018), the most ideal way for individuals to demonstrate their existence is through basing their emotions and ideas upon rationalism and science. To this end, one must possess different standpoints.

We notice that most of the time, teachers apply the conventional methods of teaching while explaining the relationships between theorems or providing axioms. Developing the new concepts that are necessary for students to be able to generalize through induction is another problem at the conventional fixed environments (Güven & Karataş, 2003). The utilization of concept cartoons in geometry for minimizing these problems, establishing a positive student attitude towards geometry,

and providing permanence in education is an alternative starting point (Şahin, 2018). Concept cartoons were first suggested at 1991 by Brenda Keogh and Stuart Naylor. Concept cartoons strategy was outlined in 1993 (Keogh and Naylor, 1993, transf. Keogh and Naylor, 1999).According to Uğurel, Keskin, and Karahan (2013), it was determined that the usage of concept cartoons would be an alternative way for Mathematics and Geometry teaching. It was detected that the concept cartoons affect the mathematical success positively, and change the attitude towards mathematics in a positive manner (Şengül & Dereli, 2013).

With regards to Dale's cone of experience, for permanent learning to occur the most effectively, it is required for individual to take part actively in the process. Yet, the portion reserved for these attitudes in the conventional teaching approaches is very limited. Rather than the conventional methods, the learning environments that are based on new approaches enable the learning to be permanent. Some studies that support this thought are available in the literature.

Türkoğuz and Cin (2013) have examined the students' levels of perception in the classroom environment assisted with concept cartoons at a study they conducted with 54 seventh-grade students in a science and technology class. As a result of the research, they have observed that there is a significant difference between a concept cartoon-assisted teaching environment and a conventional method-applied teaching environment in terms of success. It was observed that there was an academic success augmentation in the educational environment that was assisted by the concept cartoons.

Seçkin, Yalvaç, and Çetin (2010), in the study they conducted with a 100 eight-graders, have researched the concept cartoon-assisted educational environment's impact on the students' perception. At the end of the research, it was spotted that students knew most of the environmental issues but could not explain their relationships with regards to each other. In order for them to be able to establish the relationship between the concepts and ensure the permanence, it was concluded that concept cartoons must be used in elementary school desks. It was stated that concept cartoons are strong materials in terms of making the teaching process more entertaining, as well as giving advice, and that they are an effective educational material since they can be easily perceived by students.

In the published postgraduate thesis of Evrekli (2010), 34 elementary school students were used in order to examine the usage of concept cartoons' effect on student success in science and technology class. At the end of the study, there was a significant difference between the students who studied in a concept cartoon based educational environment and the students who studied in a conventional educational environment in terms of their success in the posttesting. It was observed that the success in the concept cartoon-assisted educational environment was greater. In addition, the students who presented their questioning skills thanks to the concept cartoons were more successful. In conclusion, the educational environments in which the concept cartoons are used affect the students' academic success and questioning skills positively.

As well as affecting the students' attitude towards geometry positively, concept cartoons are alternative educational tools that can be applied for the supplying of permanent teaching, and the elimination of possible misconceptions. The thought that how important the concept cartoon-assisted educational environments are in terms of enhancing the geometry achievement academically was the source of inspiration that led to this research. Accordingly, the purpose of the study is to examine the effects of concept cartoons on the geometry success in fifth-grade level geometry teaching. In accordance with this purpose, the problem statement "Does the concept cartoon-assisted education have effect on students' geometry achievement in geometry class?" is the foundation of our study. Based on this problem statement, the sub-thoughts "The examination of experimental group students' geometry achievement" and "The examination of control group students' geometry achievement" have emerged.

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METHOD

Design of the Study

For the analysis of the data collected from the experimental study, out of the experimental designs, "Pretest - Posttest Matched Pair Control Group Randomized Design" and "Unrelated Samples t-test" were utilized.

Table 1. Randomized design with pretest-posttest matched control group

G_1	R	$O_{1.1}$	X_1	$0_{1.2}$
G_2	R	$O_{2.1}$	X_2	$O_{2.2}$

G1: The Concept Cartoon usage-based geometry teaching applied group
G2: The conventional education-based geometry teaching applied group
X1: The Concept Cartoon-assisted education-based geometry teaching
X2: The conventional education-based geometry teaching
O1.1, O1.2: Pretest
O2.1, O2.2: Posttest
R: Indicates that the experimental objects were assigned randomly.

In order to increase the chances of groups being equivalent, the matched pair randomized design was utilized (Büyüköztürk, Akgün, Karadeniz, Demirel and Kılıç, 2012).

The concept cartoons were applied to the experimental group according to 2016-2017 academic year Mathematics class geometry learning outcomes. And for the control group, the conventional method-based geometry teaching was used. Before the commencement of educational applications, the geometry test was applied to the groups as the pretest, and reapplied as the posttest after the ending of educational applications. The findings were noted and included in the analysis process.

Study Group

24 fifth-grade students from Aşağı Gündelen Middle School in Konya, Ereğli constituted the study group of the research. 14 students of the group were girls, and 10 were boys. The Experimental Group that the concept cartoon-assisted education shall be used is composed of 7 girls and 5 boys, in total of 12 students, and the Control Group that conventional education shall be used is composed of 7 girls and 5 boys, in total of 12 students. Groups were formed homogeneously according to the pretest results, and were arranged to be equal in terms of achievement levels.

Data Collection Tools

The "Geometry Achievement Test", which was prepared by Şahin and Keşan (2017) via its application on 513 sixth-grade students, is used in the study. The reliability coefficient of the test results are determined as KR20 (alpha) 0,87 and KR21 0,847. In the conducted item analysis test (ITEMAN), the test's item difficulty index was determined as 0,470 and its index of distinctiveness was determined as 0,486. These results indicate that the developed "Geometry Achievement Test" is a reliable and valid measurement tool.

Data Analysis

The data was examined under the S.P.S.S. program and Tuition Assistance Program. Unrelated samples t-test was applied to the data groups that demonstrated normal distribution at the end of the examinations. And for the non-normal distribution data groups, Mann Whitney U-test and Wilcoxon signed-rank test were applied. Interpretations were made on the basis of the obtained findings and the results of the experimental research emerged.

RESULTS

The findings obtained from the research and the interpretations are presented in this section.

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Table 2. Geometry achievement test normality distributions

Measurement	Group				Shapiro-Wilks		
Geometry Achievement Test		**N**	**Mean**	**Std.Dev.**	**Statistics**	**df**	**p**
	Experimental Group Pretest	12	13.58	5.4	.914	12	.242
	Control Group Pretest	12	12.16	4.3	.917	12	.263
	Experimental Group Posttest	12	17	6.38	.933	12	.414
	Control Group Posttest	12	16.33	7.84	.936	12	.454

Since the Shapiro-Wilk values are p>.05, the data demonstrates normal distribution. Of the cartoon-assisted geometry teaching-applied experimental group and conventional education-based geometry teaching-applied control group;

a. In order to find the answer of the question "Is there a significant difference between geometry gain levels pretest score averages?", the "Geometry Achievement Test" was applied to 24 fifth-grade students. The findings that were obtained as a result of the application have been determined as the pretest score average and have been depicted at the Table 3.

Table 3. Geometry gain level pretest score averages

Group	N	Mean	Std.Dev.	df	t	p
Experimental	12	13.58	5.4	22	.711	.485
Control	12	12.16	4.3			

Since the data depicted in the Table 2 demonstrated normal distribution, we have applied the unrelated samples t-test. According to the Table 3, there is not a significant difference between the groups' "Geometry Achievement Test" pretest score averages, meaning that the groups demonstrated a homogeneous distribution ($t_{(22)}$=.771, p>.05). The cartoon-assisted geometry teaching-applied experimental group's achievement average (13.58) turned out to be higher than the conventional education-based geometry teaching-applied control group's achievement average (12.16).

It is possible to interpret this outcome as a result of the experimental and control groups' readiness levels being close. Groups answering or interpreting the questions in the "Geometry Achievement Test" similarly is because they were taught Mathematics by the same teacher and the same methods in the fourth-grade in primary school.

b. In order to find the answer of the question "Is there a significant difference between geometry gain levels posttest score averages?", the "Geometry Achievement Test" was applied to the cartoon-assisted geometry teaching-applied experimental group and to the conventional education-based geometry teaching-applied control group. The findings that were obtained as a result of the application have been depicted at the Table 4.

Table 4. Geometry gain level posttest score averages

Group	N	Mean	Std.Dev.	df	t	p
Experimental	12	17	6.38	22	.228	.821
Control	12	16.33	7.84			

In order to detect whether or not there is a significant difference between the cartoon-assisted geometry teaching-applied experimental group and the conventional education-based geometry teaching-applied control group in terms of posttest score averages, unrelated samples t-test was applied since the measurements demonstrated a normal distribution. The results obtained are given in Table 4. It was observed that there is not a significant difference between the groups' "Geometry Achievement Test" posttest score averages ($t_{(22)}$=.228, p>.005).

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The experimental group's posttest achievement average (17) turned out to be higher than the control group's posttest achievement average (16.33). Even though there is not a significant difference, it can be said that the concept cartoons affect the achievement positively.

c. In order to find the answer of the question "Is there a significant difference between the cartoon-assisted geometry teaching-applied experimental group's geometry gain levels pretest-posttest score averages?", Table 5 was created by benefiting from Table 3 and Table 4.

Table 5. Experimental group geometry achievement test pretest-posttest score averages

Experimental Group	N	Mean	Std.Dev.	df	t	p
Pretest	12	13.58	5.40	11	8.71	.000
Posttest	12	17	6.38	11	9.22	

Unrelated samples t-test was implemented since the pretest-posttest score averages demonstrated a normal distribution after the observation of "Geometry Achievement Test" results. The results of the test are presented in Table 5. It is observed that there is a significant difference between the pretest and posttest score averages of the cartoon-assisted geometry teaching-applied experimental group when the Table 5 is examined. The posttest score average (17) is greater than the pretest score average (13.58). The concept cartoons have made a positive contribution to the augmentation of experimental group's achievement.

d. In order to find the answer of the question "Is there a significant difference between the conventional education-based geometry teaching-applied control group's geometry gain levels pretest-posttest score averages?", Table 6 was created by benefiting from Table 3 and Table 4.

Table 6. Control group geometry achievement test pretest-posttest score averages

Control Group	N	Mean	Std.Dev.	df	t	p
Pretest	12	12.16	4.30	11	9.79	.000
Posttest	12	16.33	7.84	11	7.21	

Unrelated samples t-test was implemented since the pretest-posttest score averages demonstrated a normal distribution after the observation of "Geometry Achievement Test" results. The results of the test are presented in Table 6. It is observed that there is a significant difference between the pretest and posttest score averages of the conventional education-based geometry teaching-applied control group when the Table 6 is examined. The posttest score average (16.33) is greater than the pretest score average (12.16).

DISCUSSION AND CONCLUSION

After the analysis of the data obtained from the experimental application, it was detected that there is a significant difference between the cartoon-assisted geometry teaching-applied experimental group's success and the conventional education-based geometry teaching-applied control group's success. The experimental group was more successful than the control group. When these results are examined, it can be said that the concept cartoon application affects the students' geometry achievement positively. This results show parallelism with the studies conducted by Uğurel, Keskin and Karahan (2013), Şengül and Dereli (2013), Erdağ (2011).

Among the reasons of this positive effect, factors such as alluring the students' attention, concept cartoons providing a meaningful image in students' minds, ensuring students to focus on the related learning outcome, motivating students for the class can be exemplified.

While preparing the concept cartoons; elements such as students' ages, learning skills, readiness levels, educational environment, the learning outcome to be taught, or ability must be taken into consideration. And in terms of content, the concept cartoons must be prepared appropriately with regards to the environment that the student lives in, the sociocultural structure, and the family's

internal structure. In this context, the internal structure of the concept cartoons must be prepared exquisitely. The inappropriately prepared concept cartoons might divert the students from the intended message. Should such factors that affect the student's psychology be disregarded, a negative educational environment would get established instead of a positive one.

Based on the results of the research, the following recommendations can be made;

-the concept cartoons can be used as an alternative method for fifth-grade geometry education.

-the learning environments that are created via the preparation of concept cartoons can be augmented in the literature.

-the prospective teachers can be informed about the concept cartoons.

-more information about the concept cartoons can be provided to the teachers on duty via in-service trainings.

-the concepts in the Mathematics textbooks can be given via the concept cartoons.

-different practicable learning environments can be established through the combination of the concept cartoons and technology-supported platforms.

-the studies about alternative educational environments that can be used to change students' attitudes towards geometry for the better can be enhanced.

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